1 Introduction

1.1 Scope

This standard is intended to apply to the design, construction, repair, alteration, location, installation, and operation of anhydrous ammonia systems including refrigerated ammonia storage systems.

This standard does not apply to:

- Ammonia manufacturing plants;
- Refrigeration systems where ammonia is used solely as a refrigerant. Such systems are covered in American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 15, *Safety Standard for Refrigeration Systems* and ANSI/International Institute of Ammonia Refrigeration (IIAR) 2, *American National Standard for Equipment, Design and Installation of Closed-Circuit Ammonia Mechanical Refrigerating Systems* [1, 2][1];
- Ammonia transportation pipelines; and
- Ammonia barges and tankers.

1.2 General

Where certain provisions of this standard impose undue hardship or where literal adherence to such provisions fails to provide adequate safety in the opinion of the authority having jurisdiction (AHJ), the AHJ may permit deviation from the standard.

The values stated in customary units are to be regarded as standard. Metric equivalents where shown in this standard may not be exact, and meet the requirements of ANSI/Institute of Electrical and Electronics Engineers (IEEE) SI 10, *American National Standard for Metric Practice* procedures in this regard [3].

1.3 Physical/chemical properties of ammonia

1.3.1

Gaseous ammonia liquefies under pressure at ambient temperature. Ammonia is usually shipped or stored as a liquid under pressure. When refrigerated to or below its normal boiling point of –28 °F (–33.3 °C), it may be shipped or stored as a liquid at or near atmospheric pressure.

1.3.2

Some physical properties of ammonia are listed in Table 1.

1.3.3

During liquid releases, ammonia aerosol can form. This aerosol can reach temperatures approaching –100 °F (–73 °C) near the point of release [6].

1.3.4

Ammonia is extremely hard to ignite and is a relatively stable compound. It begins to dissociate into nitrogen and hydrogen at approximately 850 °F (454 °C) at atmospheric pressure. Experiments conducted by a nationally recognized laboratory showed that an ammonia-air mixture in a standard quartz test container does not ignite at less than 1562 °F (850 °C). Ammonia gas is flammable in air in the range of 16% to 25% by volume. Conditions favorable for ignition are seldom encountered during normal operations due to the high ignition temperature required.

[1] References are shown by bracketed numerals and are listed in the order of appearance in the reference section.

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1.1.2 This standard does not apply to:

1.1.2.1 Ammonia manufacturing plants;

1.1.2.2 Refrigeration systems where ammonia is used solely as a refrigerant. Such systems are covered in ANSI/ASHRAE 15, *American National Standard Safety Code for Mechanical Refrigeration* [1][1] and ANSI/IIAR 2, *American National Standard for Equipment, Design, and Installation of Ammonia Mechanical Refrigerating Systems* [2];[2]

1.1.2.3 Ammonia transportation pipelines; and

1.1.2.4 Ammonia barges and tankers.

1.2 General

1.2.1 Where certain provisions of this standard impose undue hardship or where literal adherence to such provisions fails to provide adequate safety in the opinion of the authority having jurisdiction, the authority having jurisdiction may permit deviation from the standard.

1.2.2 The values stated in customary units are to be regarded as standard. Metric equivalents where shown in this standard may not be exact, and follow ANSI/IEEE *Metric Practice* procedures in this regard [3].

[1] References in this document are shown by bracketed numerals and are listed in the order of appearance. See Section 13. References.

[2] As an aid to the reader in identifying technical changes from the previous edition, a shaded area appears in the affected paragraph or subparagraph.

1.3 Physical/chemical properties of ammonia

1.3.1 Gaseous ammonia liquefies under pressure at ambient temperature. Ammonia is usually shipped or stored as a liquid under pressure. When refrigerated to or below its normal boiling point of -28.17 °F (-33.43 °C), it can be shipped or stored as a liquid at or near atmospheric pressure.

1.3.2 Some physical properties of ammonia are listed in table 1.

1.3.3 During liquid releases, ammonia aerosol may form. This aerosol can reach temperatures approaching -100 °F (-73 °C) near the point of release [4].

1.3.4 Ammonia is extremely hard to ignite and is a relatively stable compound. It begins to dissociate into nitrogen and hydrogen at approximately 850 °F (454 °C) at atmospheric pressure. Experiments conducted by a nationally recognized laboratory showed that an ammonia-air mixture in a standard quartz test container does not ignite at less than 1562 °F (850 °C). Ammonia gas is flammable in the air in the range of 16% to 25% by volume. Conditions favorable for ignition are seldom encountered during normal operations due to the high ignition temperature required. However, the release of ammonia gas into a tightly enclosed or inadequately ventilated space may result in the accumulation of a flammable mixture that can cause a combustion explosion if a high temperature ignition source is present.

1.3.5 Under some circumstances ammonia and ammonium compounds can react with other chemicals to form explosive products. Ammonia should never be combined with other chemicals unless the possible reactions have been adequately investigated and appropriate precautions taken. Refer to NFPA 45, *Hazardous Chemicals Data* [5].

1.3.6 Although most metals are not attacked by ammonia, zinc, copper, and copper base alloys such as brass are subject to rapid deterioration by ammonia. Certain high tensile strength steels have developed stress-corrosion cracking in ammonia contaminated with small quantities of air. Such cracking can be minimized by the consistent use of